VAPOR INTRUSION REPORT
i.park EDGEWATER
45 RIVER ROAD
EDGEWATER, NEW JERSEY
ISRA CASE #E20030062 and
#E20040267

PREPARED FOR:
New Jersey Department of Environmental Protection
Bureau of Industrial Site Remediation
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On behalf of:
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TABLE OF CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

GZA GeoEnvironmental, Inc. (GZA) has prepared this Vapor Intrusion (VI) Report for the property known as i.park Edgewater located at 45 River Road in Edgewater, Bergen County, New Jersey (Site). This report is being submitted as Appendix A of GZA's November 2007 *Supplemental Remedial Investigation Report/Remedial Action Work Plan* (SRIR/RAWP). This report has been prepared in general accordance with the requirements of the NJDEP's June 30, 2006 comment letter and the NJDEP's October 2005 *Vapor Intrusion Guidance* (VIG) to evaluate the vapor intrusion pathway and recommend appropriate remedial actions, if necessary.

Several investigations at the Site have been conducted by both GZA and Langan Engineering, Inc. (Langan) and a detailed review of these sampling results, as well as the Site description and history, are included in the SRIR/RAWP and will not be discussed in detail here. A summary of the historical sampling results as they relate to potential vapor intrusion issues followed by a technical review of the samples collected as part of the Supplemental Remedial Investigation are included below. A summary of the appropriate remedial alternatives based on the vapor intrusion pathway assessment is included in **Section 7.0**. These remedial actions were also included in the Section 14.5.5 of the SRIR/RAWP.

2.0 SITE HYDROGEOLOGY

Based on a review of the U.S. Geologic Survey Map, Central Park, N.Y.-N.J., 1995, elevations on and within the vicinity of the Site are approximately 15 feet above mean sea level (MSL). Groundwater on the Site occurs within the pore space of the unconsolidated fill and soils and in the bedrock. Four hydrostratigraphic units (zones) have been identified from the ground surface down as follows: 1) fill material, 2) clay/silt, 3) sand (localized), and 4) bedrock. The water table varies from approximately 3.5 to 5 feet bgs at the Site. Groundwater flow is generally from west to east toward the Hudson River, although the flow direction shows some variation. These variations are possibly due to subsurface heterogeneities in the fill material, as well as current and former subsurface utilities. Vertical hydraulic gradients between the upper and lower groundwater zones at the Site show an upward gradient in two of the three monitoring well couplets installed.

Nearby surface water bodies include the tidally influenced Hudson River, which bounds the Site to the east and flows south into New York Harbor. The Hudson River is tidally influenced with water level fluctuations typically ranging between three and six feet across a tidal cycle. The tidal fluctuations in the river cause a pressure front that "moves" through the aquifer and affects the shallow water table beneath a portion of the Site. The zone of tidal influence appears to be relatively narrow (0.34 foot effect measured in a well located 50 lateral feet from the river and little to no measurable effect in two wells located 420 and 550 lateral feet from the river).

3.0 REDEVELOPMENT PLAN

The conceptual Site development plan calls for utilizing the Site as a mixed use residential and retail commercial facility. Under the redevelopment plan Buildings 1 and 5 will be renovated and reused for residential purposes. Building 9 will be reused for commercial purposes. Several new structures will be built on the Site as indicated on **Figure 1**, including three residential buildings, an affordable housing unit, five residential over retail buildings, one commercial building, a gym, a municipal building, and parking lots.

All of the on-Site buildings have been demolished, except those which will be incorporated into the redevelopment. The concrete building pads from the demolished structures will remain in place and will be reused wherever possible. The redevelopment will take place in a phased-approach. Phase I consists of the renovations to Buildings 1 and 5 and construction of the municipal building. The remaining Site development will take place as part of Phase II. Development of the northern portion of the Site will be curtailed until the United States Environmental Protection Agency (USEPA) has completed its remedial investigation and selected a remedy for the Quanta site.

4.0 SUMMARY OF PREVIOUS INVESTIGATION ACTIVITIES

In accordance with Stage 3 of the "Decision Flow Chart for the Vapor Intrusion Pathway" included in the VIG, all previously collected groundwater and soil gas sample results collected at the Site were compared to the appropriate screening levels. A discussion of the results is presented below.

4.1 Groundwater

The most recent groundwater data collected from the 56 on-Site monitoring wells and 16 temporary wells were compared to the NJDEP's Groundwater Screening Levels (GWSLs) contained in the VIG. Benzene was detected in the groundwater beneath the Site at concentrations exceeding the GWSL in three areas on the Site: in the vicnity of MW-32, MW-55 and MW-3; around Building 2 in MW-54 and MW-70; and in the South Visitor's Parking Lot (**Figure 1**). Trichloroethene (TCE) has been detected in five wells on-Site above GSLs. Three of the wells are on the northern portion of the Site, one is located in the middle of the Site (MW-70) and one is located on the southern end of the Site (MW-71). Vinyl chloride has also been detected in two monitoring wells above GSLs, MW-29 on the northern end of the Site and MW-70 in the middle of the Site.

4.2 Soil Gas and Indoor Air

Soil gas and indoor air samples have been previously collected from the Site to assess the vapor intrusion pathway for the buildings which will remain during redevelopment of the Site.

4.2.1 Buildings 1 and 5

In March 2005, GZA evaluated potential volatile organic compound (VOC) contamination in soil vapor below the slabs of Buildings 1 and 5. Six sub-slab samples (three from each building) were collected and one indoor air sample was collected from outside of Building 1. These seven samples were analyzed for TO-15 compounds. Of the six sub-slab soil vapor samples, only 1,4-dichlorobenzene at 340 ug/m^3 in sample 2-01-HK exceeded the Soil Gas Screening Level (SGSL) of 32 ug/m^3. Because no VOCs were detected in the ambient air sample, all detections were attributed to the soil vapor below the building slab. The NJDEP requested collection of another sub-slab sample from the same location to confirm the result. The sample was collected as part of the Supplemental Remedial Investigation and the results are presented below in **Section 5.0**.

4.2.2 Building 9

Temporary soil vapor probes were installed at eight locations around the perimeter of Building 9 and one indoor air quality sample was collected from the first floor of Building 9. All soil gas sample locations were located within ten feet of the Site building and installed at a depth of five feet bgs. Analytical results indicated tetrachloroethene (PCE) in soil gas samples GZA-51, GZA-54, GZA-57, and GZA-58 and trichloroethene (TCE) in soil gas sample GZA-52 were present above Non-Residential Soil Gas Screening Levles (SGSLs). Concentrations of TCE/PCE ranged from 27 to 47 ug/m^3. Six compounds were detected in the indoor air sample but all results were less than the Non-Residential Indoor Air Screening Levels (IASLs) and were similar to concentrations detected in the outdoor ambient air sample. The NJDEP requested confirmation indoor air sampling and analysis of all air samples for TO+15 and naphthalene. These samples were collected as part of the Supplemental Remedial Investigation and the results are presented below in **Section 5.0**.

5.0 CONFIRMATION SAMPLE COLLECTION AND RESULTS

As requested by the NJDEP, confirmation sub-slab and indoor air samples were collected from Building 1 and 9, respectively. The samples were collected in general accordance with the VIG, the NJDEP *Field Sampling Procedures Manual* (August 2005), and the Site-specific Health and Safety Plan.

5.1 Sample Collection

5.1.1 Sub-Slab Sampling

As requested by the NJDEP, one sub-slab confirmation sample was collected from Building 1 in room HK (**Figure 2**). Teflon tubing was inserted through the floor to immediately below the building slab. The tubing was then sealed with bentonite. To verify the integrity of the annular seal, the location was leak tested using helium as a

tracer gas. Once the sampling location was determined to be gas-tight, a six liter summa canister was used to collect the sample over an approximately one hour period.

An indoor air sample was also collected from inside Building 1 concurrently with the sub-slab samples to assess indoor/background concentrations. All samples were sent to Test America of Burlington, Vermont for analysis of TO-15 compounds and naphthalene.

5.1.2 Indoor Air Sampling

Indoor air samples were collected from the first and second floors of Building 9 over a period of approximately 24 hours. Sampling locations were determined based on the layout of the HVAC system. The samples were collected from breathing zone height, approximately four feet from the floor.

An ambient air sample was also collected over the same time period as the indoor air sample. The background sample summa canister was placed outside the west side of Building 6 (see **Figure 2**). Indoor air and ambient air samples were analyzed for TO-15 compounds with a gaseous naphthalene standard at TestAmercia of Burlington, Vermont.

5.2 Sample Results

5.2.1 Sub-Slab Sampling

No exceedances of the SGSLs were detected in the sub-slab sample collected from beneath Building 1. 1,4-dichlorobenzene was previously detected above the SGSL in the soil gas beneath Building 1 (**Table 1**).

5.2.2 Indoor Air Sampling

No exceedances of the IASLs were detected in the indoor air samples collected from Building 9. This confirms the results of the previously collected indoor air samples from Building 9 (**Table 2**).

6.0 ASSESSMENT OF THE VAPOR INTRUSION PATHWAY

As presented above, results of the available groundwater and soil gas data exceeded the NJDEP screening levels. The next stage of assessment of the vapor intrusion pathways includes determining whether additional data are needed to assess the vapor intrusion pathway. Remedial actions to address any potential vapor intrusion issues are discussed in **Section 7.0**.

6.1 Existing Buildings (Building 1, 5, and 9)

Per the NJDEP guidance, an investigation of the vapor intrusion pathway is conducted whenever a structure is within 100 feet of groundwater contamination above the

GWSL. Buildings 1 and 9 are both located within 100 feet of VOCs detected in groundwater above the GWSL. Building 5 is not located within 100 feet of VOCs detected in groundwater above the GWSL. The next step in the assessment of the vapor intrusion pathway is to collect sub-slab and indoor air samples from target buildings; however, as discussed above, these samples have already been collected.

Results from the sub-slab samples collected from beneath Building 1 showed one compound above the SGSL, but this compound was not detected above the IASL in the indoor air sample. Confirmation samplings indicated no compounds were detected above the SGSL in the sub-slab soil gas. Near slab samples collected around Building 9 indicated TCE and PCE concentrations above the SGSL. Two separate sampling events showed no compounds present above the IASL in the indoor air. Based on these results, the vapor intrusion pathway is incomplete and no further investigation is required for Buildings 1 and 9.

6.2 Proposed Buildings

Based on groundwater exceedances of VOCs and the proposed redevelopment plan, all of the new buildings are located within 100 feet of a monitoring well with VOC detections above the GWSL. Since sub-slab and indoor air samples cannot be collected until after construction of the buildings, the next step would be to collect exterior soil gas samples from the locations of the proposed buildings. In lieu of collecting the additional samples, a proactive conservative remediation approach of installing passive ventilation systems with the ability to be modified to active systems has been proposed to mitigate potential future vapor intrusion issues at the Site. Remedial actions to address any potential vapor intrusion issues are discussed in **Section 7.0**.

7.0 REMEDIAL ACTION EVALUATION

7.1 Existing Buildings (Buildings 1, 5 and 9)

According to the Remediation Decision Matrix, Stage 8 of the Decision Flow Chart for the Vapor Intrusion Pathway, no action or monitoring is required when sample results indicate the exceedances of the SGSLs but no exceedances of the IASLs. Factors to assess whether monitoring is necessary include the relative exceedances of the screening level, the ratio of the soil gas and indoor air results, building construction, and possible affects of background sources of contamination.

Only one compound was detected above the SGSL in the soil gas beneath Building 1. Confirmation sampling sub-slab and all indoor air samples collected did not detect any compounds above the SGSL or the IASL; therefore, indoor air quality monitoring is deemed not to be necessary for Building 1 and 5 and the vapor intrusion pathway is incomplete.

TCE and PCE were detected in the near slab samples collected around Building 9. Two rounds if indoor air sampling did not detect these samples in the indoor air. In addition, Building 9 was constructed with a vapor barrier. Based on the sampling results and the building construction, monitoring is deemed not to be necessary for Building 9 and the vapor instruction pathway is incomplete.

However, to be conservative, i.park will conduct one sampling round of verification sampling following renovations to buildings 1, 5 and 9 and prior to re-use.

All utility penetrations in Building 1, 5 and 9 will be sealed (i.e. if they are installed in a 2-3" conduit, the annular space within the conduit will be sealed). Also, anytime the existing slab is cut for utility work, it will be reconstructed with water stops at the seam, or in some method that will ensure a tight seal and prevent vapor migration.

7.2 Proposed New Buildings

Remediation will be required to address potential future vapor intrusion issues at the Site. Remediation of VOC-impacted soils around MW-55, MW-3 and MW-43 is proposed in the RAWP for the Site and all new structures will contain a passive venting system that can be converted to an active depressurization system.

Vapor barriers and depressurization systems are an accepted engineered remedial strategy to address potential vapor intrusion issues. This can be accomplished through various designs including liners, spray-on barriers, active venting systems and passive venting systems. The goals of these designs are either to create a barrier which will prevent VOCs from entering a building, or to depressurize the soils beneath the building foundations so as the create a pressure gradient that will not allow vapors to enter the building. We have selected a combination of a vapor barrier and a passive sub-slab depressurization system. This will be incorporated into the design of all new buildings to be occupied by residents or commercial/retail in order to protect future occupants from residual VOC contamination. The systems will be designed with the ability to convert to an active system if warranted.

7.2.1 Verification Sampling

After the installation of the sub-slab ventilation system and barrier, confirmation indoor air sampling will be conducted. Samples will be collected at least two to four weeks after the system is operational to verify the effectiveness of the system. All indoor air samples and appropriate background samples will be collected pursuant to the requirements set forth in the NJDEP Vapor Intrusion Guidance.

The system will also be inspected biannually. Results of the inspections will be included in Remedial Action Progress Reports to be submitted in accordance with N.J.A.C. 7:26(e).

Table 1
Sub-Slab Soil Gas
Analytical Results
Building 1
45 River Road
Edgewater, New Jersey

Sample ID Sampling Date Matrix Units	NJDEP Residential Soil Gas Screening Levels		NJDEP Nonresidential Soil Gas Screening Levels		1-HK 10/26/2006 AIR	
	ug/m^3	ppbv	ug/m^3	ppbv	ppbv	ug/m^3
COMPOUND						
Acetone (2-propanone)	160,000	69,000	23,000	97,000	20	48
Benzene	16 0	5	26 0	8	0 28	0.89
2-Butanone (Methyl ethyl ketone)	260,000	87,000	360,000	120,000	3 8	11
Chloromethane (Methyl chloride)	4,700	2,300	6,600	3,200	0 5 U	1
1,4-Dichlorobenzene	30	5	32	5	0 73	4.4
Dichlorodifluoromethane	9,100	1,800	13,000	2,600	0 63	3.1
Ethylbenzene	5,300	1,200	74,000	17,000	0 81	3.5
4-Ethyltoluene (p-Ethyltoluene)	—	—	—	—	0 93	4 6
n-Heptane	—	—	—	—	0 84	3.4
Tetrachloroethene (PCE)	34	5	36	5	2.6	18
Toluene	260,000	68,000	360,000	95,000	3 4	13
Trichlorofluoromethane (Freon 11)	36,000	6,500	51,000	9,100	0 64	3 6
1,2,4-Trimethylbenzene	—	—	—	—	1.2	5 9
1,3,5-Trimethylbenzene	—	—	—	—	0 32	1.6
2,2,4-Trimethylpentane	—	—	—	—	12	56
Xylenes (total)	5,500	1,300	7,700	1,800	3 98	17.3
Naphthalene	—	—	—	—	0 5 U	2 6

Notes

U The analyte was not detected at or above the reporting limit.

Exceeds Standard

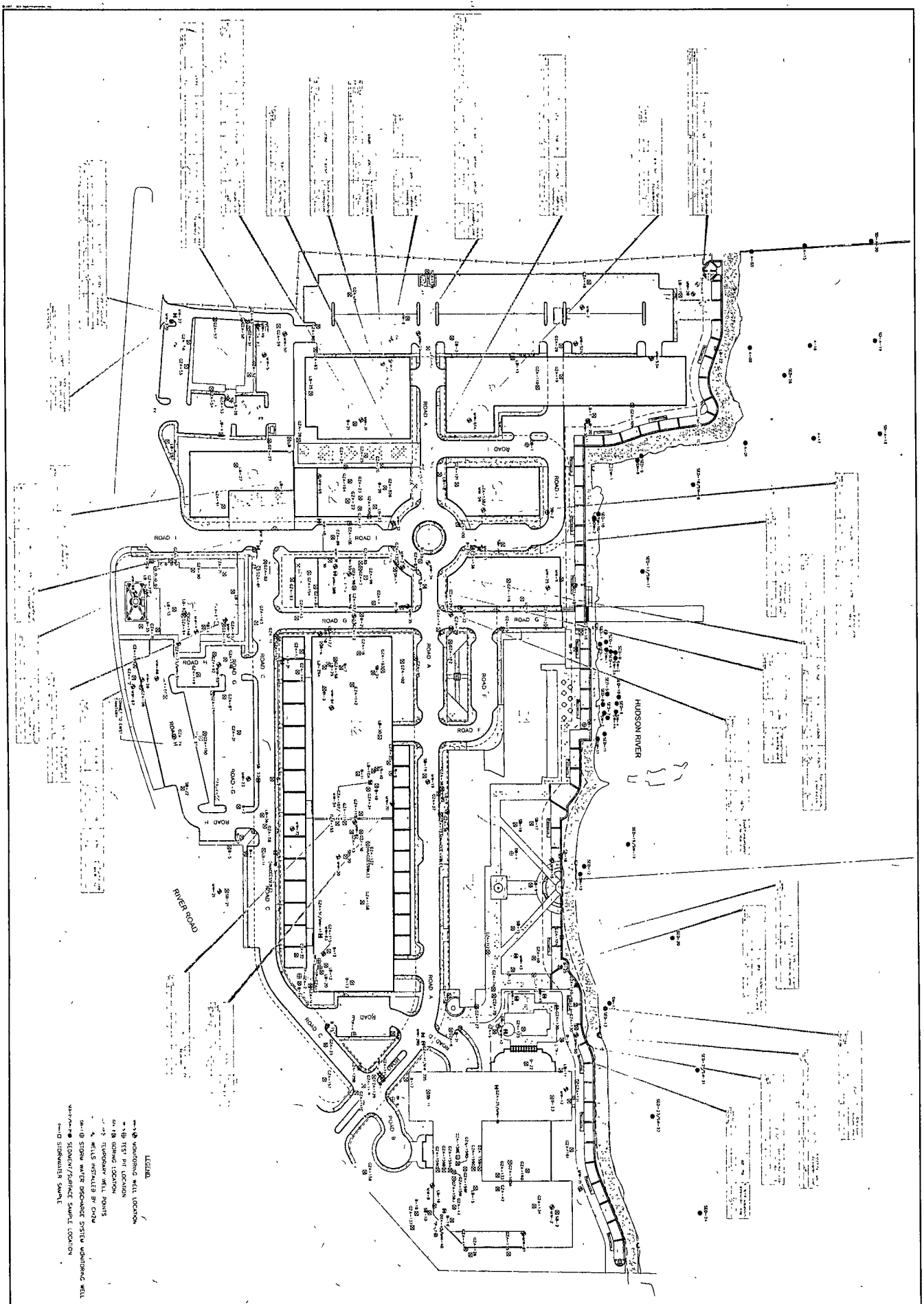
Only detected parameters are included in this table. Refer to laboratory data report for complete analytical results

Table 2
Indoor Air Quality Analytical Results
Buildings 1 and 9
45 River Road
Edgewater, New Jersey

Sample ID	NJDEP Residential Screening Levels		NJDEP Nonresidential Screening Levels		1-109		9-COMMON		9-ENTRY		9-108		9-124		9-126		9-205		9-213		BACKGROUND		1-BACKGROUND	
Sampling Date					10/27/2006		10/27/2006		10/27/2006		10/27/2006		10/27/2006		10/27/2006		10/27/2006		10/27/2006		10/27/2006		10/26/2006	
Matrix					AIR		AIR		AIR		AIR		AIR		AIR		AIR		AIR		AIR		AIR	
Units	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3
2-Butanone (Methyl Ethyl Ketone)	1 700	5,100	2,400	7,200	2 3	6 8	2 6	7 7	3 4	10	2 5	7 4	3 7	11	3 9	12	1 8	5 3	4	12	3 2	9 4	5 5	16
4-Ethyltoluene (p-Ethyltoluene)	—	—	—	—	0 2 U	0 98	0 2 U	0 98	0 2 U	0 98	0 2 U	0 98	0 2 U	0 98	0 2 U	0 98	0 2 U	0 98	0 2 U	0 98	0 2 U	0 98	0 2 U	0 98
Acetone (2-Propanone)	1,400	3,300	1,900	4,600	11	26	12	29	15	36	15	36	17	40	21	50	16	38	23	55	20	48	33	78
Benzene	0 5	2 0	0 5	2 0	0 2 U	0 64	0 2 U	0 64	0 25	0 8	0 23	0 73	0 2 U	0 64	0 24	0 77	0 23	0 73	0 22	0 7	0 23	0 73	0 2 U	0 64
Chloromethane (Methyl Chloride)	46	95	64	130	0 51	1 1	0 51	1 1	0 55	1 1	0 55	1 1	0 54	1 1	0 55	1 1	0 57	1 2	0 54	1 1	0 53	1 1	0 56	1 2
Dichlorodifluoromethane	37	180	52	260	0 56	2 8	0 56	2 8	0 64	3 2	0 61	3	0 61	3	0 62	3 1	0 63	3 1	0 61	3	0 62	3 1	0 62	3 1
Methylene Chloride	1	4	2	9	0 51	1 8	0 5 U	1 7	0 5 U	1 7	0 5 U	1 7	0 5 U	1 7	0 5 U	1 7	0 5 U	1 7	0 5 U	1 7	0 5 U	1 7	0 5 U	1 7
Naphthalene	—	—	—	—	0 5 U	2 6	0 5 U	2 6	0 5 U	2 6	0 5 U	2 6	0 5 U	2 6	0 5 U	2 6	0 5 U	2 6	0 5 U	2 6	0 5 U	2 6	0 5 U	2 6
n-Heptane	—	—	—	—	0 27	1 1	0 3	1 2	0 3	1 2	0 28	1 1	0 43	1 8	0 4	1 6	0 2 U	0 82	0 37	1 5	0 28	1 1	0 44	1 8
Toluene	1,400	5,100	1,900	7,200	0 51	1 9	0 67	2 5	0 81	3 1	0 81	3 1	0 73	2 8	0 79	3	0 77	2 9	0 72	2 7	0 67	2 5	0 47	1 8
Trichlorofluoromethane (Freon 11)	130	730	180	1,000	0 64	3 6	0 46	2 6	0 44	2 5	0 47	2 6	0 69	3 9	0 56	3 1	0 48	2 7	0 5	2 8	0 29	1 6	0 67	3 8

Qualifiers
U: The analyte was not detected at or above the reporting limit

Notes
Only detected parameters are included in this table. Refer to laboratory data report for complete analytical results



LPARK EDGEWATER
45 River Road
Edgewater, New Jersey

Groundwater Analytical Results

Vapor Intrusion Report

Figure 1

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Project Mgr: DM Reviewed By: MH
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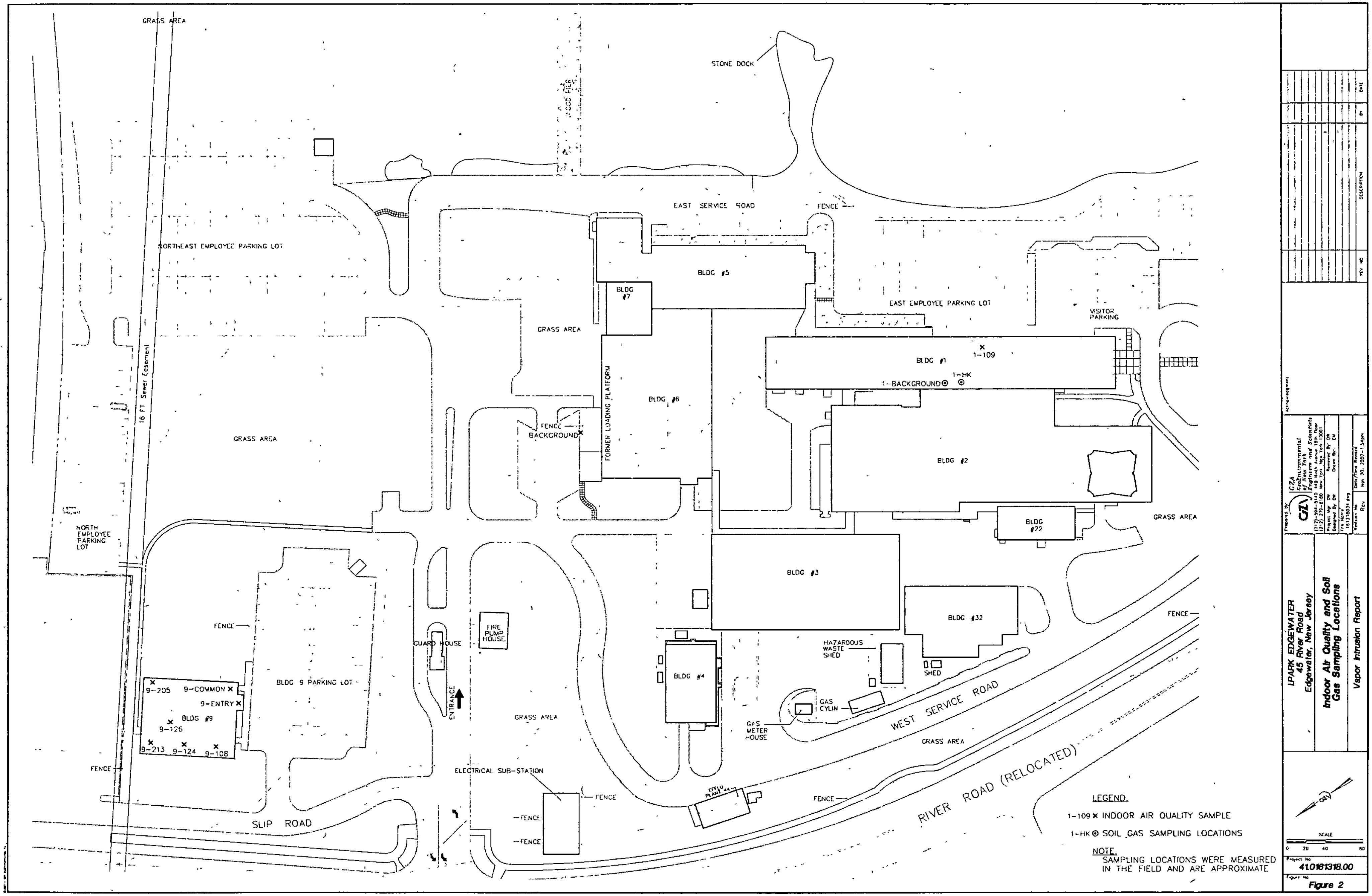

GRASS AREA
STONE DOCK
EAST SERVICE ROAD
FENCE
NORTHEAST EMPLOYEE PARKING LOT
BLDG #5
BLDG #7
EAST EMPLOYEE PARKING LOT
VISITOR PARKING
GRASS AREA
16 FT Sewer Easement
BLDG #1
1-109
1-HK
1-BACKGROUND
BLDG #6
FORMER LOADING PLATFORM
FENCE
BACKGROUND
GRASS AREA
BLDG #2
BLDG #22
GRASS AREA
NORTH EMPLOYEE PARKING LOT
BLDG #3
BLDG #32
FENCE
FIRE PUMP HOUSE
GUARD HOUSE
HAZARDOUS WASTE SHED
SHED
BLDG #4
BLDG 9 PARKING LOT
9-205
9-COMMON
9-ENTRY
BLDG #9
9-126
9-213
9-124
9-108
ENTRANCE
GRASS AREA
GAS CYLIN
GAS METER HOUSE
WEST SERVICE ROAD
GRASS AREA
ELECTRICAL SUB-STATION
FENCE
SLIP ROAD
RIVER ROAD (RELOCATED)
LEGEND
1-109 × INDOOR AIR QUALITY SAMPLE
1-HK ⊙ SOIL GAS SAMPLING LOCATIONS
NOTE
SAMPLING LOCATIONS WERE MEASURED IN THE FIELD AND ARE APPROXIMATE
REV NO
DESCRIPTION
BY
DATE
Acknowledgment
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LPARK EDGEWATER
45 River Road
Edgewater, New Jersey
Indoor Air Quality and Soil Gas Sampling Locations
Vapor Intrusion Report
SCALE
0 20 40 80
Project No
410161318.00
Figure No
Figure 2